

Appln. No.: 09/716,651
Amendment Dated March 29, 2004
Reply to Office Action of December 29, 2004

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Amendments to the Claims: This listing of claims will replace all prior versions, and listings, of claims in the application

Listing of Claims:

1. (Currently Amended) A method for processing a plurality of sequentially encoded and channel impaired sample values, the samples being encoded according to a predetermined set of code values, the method comprising the steps of:
- dividing the set of code values into a plurality of subsets, each subset including a plurality of values; and
- partially decoding and quantizing each sample value of the successive sample values in a single symbol interval, to assign the sample value to one of the subsets, wherein the partial decoding of each sample value is based on respective estimates of a current sample value and a previous sample value ~~on a current sample value of the successive sample values and on a previously decoded sample value of the successive sample values.~~
2. (Currently Amended) A method according to claim 1, wherein the sequential sample values are trellis encoded and the step of partially decoding and quantizing each sample value includes the step of calculating path metrics for the current sample value responsive to the path metrics calculated for the ~~previously decoded~~ sample value.
3. (Original) A method according to claim 1, wherein the sequential sample values are trellis encoded and the step of partially decoding and quantizing each sample value includes the step of calculating path metrics for the current sample value and using the calculated path metrics to calculate a most likely path metric of the current sample value.
4. (Original) A method according to claim 3, wherein the trellis code defines a state-transition diagram in which a change from the previous sample value to the current sample value represents a transition in the state transition diagram and every state in the state transition diagram is associated with a path metric, and the step of calculating the most likely path metric for a specific state for the next sequential sample value includes the step of selecting a most likely transition in the state transition diagram from any state corresponding to the previous sample value to a specific state of the current sample value.

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5. (Original) A method according to claim 3 wherein the trellis encoded set corresponds to a set-partitioned code.

6. (Original) A method according to claim 3, wherein the trellis encoded set of code values is a set-partitioned code encoded that uses feedback convolution codes.

7. (Currently Amended) A decoder and quantizer that ~~may be~~ used to recover N-bit symbols, where N is an integer greater than two, from successive channel impaired input samples representing a signal encoded according to a trellis code, wherein the trellis code defines a constellation, the decoder and quantizer comprising:

a plurality of decision devices, each decision device corresponding to a subset of the constellation defined for the trellis code;

a partial trellis decoder that generates an estimate of the subset to which a current symbol belongs based on respective estimates of the a current sample and on a previously decoded symbol a previous sample and, responsive to the estimate of the subset, selects one decision device of the plurality of decision devices to generate ~~the an~~ estimate of the N bits.

8. (Currently Amended) A decoder and quantizer according to claim 7, wherein the trellis code is a set partitioned code using feedback convolutional encoding and the partial trellis decoder computes path metrics for ~~a the~~ current symbol based on previously computed path metrics of ~~a the previous symbol sample~~ and determines a best path metric from among all path metrics computed for the previous ~~symbol sample~~ to select the one decision device.

9. (Currently Amended) A decoder and quantizer according to claim 7, wherein the trellis code is a set-partitioned code which defines a state-transition diagram and the partial trellis decoder computes path metrics for the current symbol based on previously calculated path metrics of the previous ~~symbol sample~~ and determines a best path from path metrics computed for the current symbol, corresponding to a subset of the states for the previous ~~symbol sample~~, to select the one decision device.

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10. (Currently Amended) A decoder and quantizer according to claim 9, further including a classifier for identifying ones of the path metrics computed for the previous ~~symbol-sample~~ as better path metrics than other ones of the path metrics computed for the previous ~~symbol-sample~~, wherein the subset of states selected for the previous ~~symbol-sample~~ are states corresponding to the identified better path metrics.

11. (Original) A decoder according to claim 10, wherein each path metric includes a measure of Euclidean distance.

12. (Currently Amended) An equalizer for a digital demodulator that demodulates a trellis coded signal having channel impaired symbols that have been digitally coded according to a constellation and then modulated onto a carrier wave, the equalizer comprising:

a finite impulse response (FIR) filter coupled to receive the trellis coded signal as a passband signal and to provide a first filtered output signal;

an infinite impulse response (IIR) filter, including a summing circuit having a first input port coupled to receive the first filtered output signal and an output port coupled to an IIR filter element, the IIR filter element being coupled to provide an output signal to a second input port of the summing circuit, the IIR filter providing a second filtered output signal at the output port of the summing circuit; and

a slicer that is selectively coupled between the output port of the summing circuit and the IIR filter element, the slicer including:

a plurality of decision devices, each decision device corresponding to a subset of the constellation defined for the trellis code;

a partial trellis decoder that generates an estimate of the subset to which a current channel impaired symbol belongs based on the ~~respective estimates of a current sample~~ and on a ~~previously decoded channel impaired symbol~~ previous sample and, responsive to the estimate of the subset, selects one decision device of the plurality of decision devices to generate the estimate of the current channel impaired symbol.

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13. (Original) An equalizer according to claim 12, wherein both the FIR filter and the IIR filter process passband signals to provide a passband signal as the second filtered signal.

14. (Original) An equalizer according to claim 13, further comprising:

a first mixer coupled to the output port of the summing circuit and coupled to receive an estimated residual carrier signal, for demodulating the output signal of the summing circuit to provide a baseband signal as an input signal to the slicer;

a second mixer coupled to the slicer and coupled to receive a further estimated residual carrier signal for remodulating the output signal of the slicer to provide a passband signal to the IIR filter element; and

carrier loop circuitry, coupled to receive the input signal to the slicer and the output signal of the slicer, and to provide the estimated residual carrier signal and the further estimated residual carrier signal to the first and second mixers.

15. (Original) An equalizer according to claim 12, wherein the first filtered signal provided by the FIR filter is a passband signal and the equalizer further comprises a mixer coupled between the FIR filter and the IIR filter and coupled to receive an estimated residual carrier signal to transform the first filtered signal into a baseband signal, and the IIR filter is configured to process the baseband signal to produce a further baseband signal as the second filtered signal; and

the equalizer further includes carrier loop circuitry, coupled to receive respective input signals from the output port of the summing circuit and the output port of the slicer and to provide the estimated residual carrier signal to the mixer.

16. (Original) An equalizer according to claim 12, wherein the constellation defines a code set that is a set partitioned code using feedback convolutional encoding and the partial trellis decoder computes path metrics for a current symbol based on previously computed path metrics of a previous symbol and determines a best path metric from among all path metrics computed for the previous symbol to select the one decision device.

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17. (Currently Amended) An equalizer according to claim 12, wherein the trellis code is a set-partitioned code that defines a state-transition diagram and the partial trellis decoder computes path metrics for the current channel impaired symbol based on previously calculated path metrics of the a previous symbol and determines a best path from path metrics computed for the current symbol, corresponding to a subset of the states for the previous symbol, to select the one decision device.

18. (Original) An equalizer according to claim 17, further including a classifier for identifying ones of the path metrics computed for the previous symbol as better path metrics than other ones of the path metrics computed for the previous symbol, wherein the subset of states selected for the previous symbol are states corresponding to the identified better path metrics.

19. (Original) A decoder according to claim 18, wherein each path metric includes a measure of Euclidean distance.

20. (Original) A decoder according to claim 12, wherein the plurality of decision devices consists of four decision devices, each decision device corresponding to two respective elements of the constellation defined by the trellis code.

21. (Original) An equalizer according to claim 12, wherein the trellis code is compliant with a standard for digital television terrestrial broadcast adopted by the Advanced Television Systems Committee (ATSC).

22. (Currently Amended) An equalizer for a digital demodulator that demodulates a trellis coded signal having channel impaired symbols that have been digitally coded according to a constellation and then modulated onto a carrier wave, the equalizer comprising:

a finite impulse response (FIR) filter coupled to receive a the trellis coded signal as a baseband signal and to provide a first filtered output signal;

an infinite impulse response (IIR) filter, including a summing circuit having a first input port coupled to receive the first filtered output signal and an output port coupled to an IIR


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filter element, the IIR filter element being coupled to provide an output signal to a second input port of the summing circuit, the IIR filter providing a second filtered output signal at the output port of the summing circuit; and

a slicer that is selectively coupled between the output port of the summing circuit and the IIR filter element, the slicer including:

a plurality of decision devices, each decision device corresponding to a subset of the constellation defined for the trellis code;

 a partial trellis decoder that generates an estimate of the subset to which a current channel impaired symbol belongs based on respective estimates of a the-current sample and on a previously-decoded channel impaired symbol-previous sample and, responsive to the estimate of the subset, selects one decision device of the plurality of decision devices to generate the estimate of the current channel impaired symbol.

23. (Currently Amended) An equalizer for a digital demodulator that demodulates a trellis coded signal having channel impaired symbols that have been digitally coded according to a constellation and then modulated onto a carrier wave, the equalizer comprising:

a finite impulse response (FIR) filter coupled to receive a the trellis coded signal as a passband signal and to provide a first filtered output signal;

an infinite impulse response (IIR) filter, including a summing circuit having a first input port coupled to receive the first filtered output signal and an output port coupled to an IIR filter element, the IIR filter element being coupled to provide an output signal to a second input port of the summing circuit, the IIR filter providing a second filtered output signal at the output port of the summing circuit; and

a slicer that is selectively coupled between the output port of the summing circuit and the IIR filter element, the slicer including:

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a plurality of decision devices, each decision device corresponding to a subset of the constellation defined for the trellis code;

a partial trellis decoder that generates an estimate of the subset to which a current channel impaired symbol belongs based on an estimate of a previous sample ~~previously decoded channel impaired symbol~~ and, responsive to the estimate of the subset, selects one decision device of the plurality of decision devices to generate the estimate of the current channel impaired symbol.

24. (Original) An equalizer according to claim 23, wherein both the FIR filter and the IIR filter process passband signals to provide a passband signal as the second filtered signal.

25. (Original) An equalizer according to claim 23, further comprising:

a first mixer coupled to the output port of the summing circuit and coupled to receive an estimated residual carrier signal, for demodulating the output signal of the summing circuit to provide a baseband signal as an input signal to the slicer;

a second mixer coupled to the slicer and coupled to receive a further estimated residual carrier signal for remodulating the output signal of the slicer to provide a passband signal to the IIR filter element; and

carrier loop circuitry, coupled to receive the input signal to the slicer and the output signal of the slicer, and to provide the estimated residual carrier signal and the further estimated residual carrier signal to the first and second mixers.

26. (Original) An equalizer according to claim 23, wherein the first filtered signal provided by the FIR filter is a passband signal and the equalizer further comprises a mixer coupled between the FIR filter and the IIR filter and coupled to receive an estimated residual carrier signal to transform the first filtered signal into a baseband signal, and the IIR filter is configured to process the baseband signal to produce a further baseband signal as the second filtered signal; and

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the equalizer further includes carrier loop circuitry, coupled to receive respective input signals from the output port of the summing circuit and the output port of the slicer and to provide the estimated residual carrier signal to the mixer.

27. (Original) An equalizer according to claim 23, wherein the constellation defines a code set that is a set partitioned code using feedback convolutional encoding and the partial trellis decoder computes path metrics for a current symbol based on previously computed path metrics of a previous symbol and determines a best path metric from among all path metrics computed for the previous symbol to select the one decision device.

28. (Original) An equalizer according to claim 23, wherein the trellis code is a set-partitioned code that defines a state-transition diagram and the partial trellis decoder computes path metrics for the current symbol based on previously calculated path metrics of the previous symbol and determines a best path from path metrics computed for the current symbol, corresponding to a subset of the states for the previous symbol, to select the one decision device.

29. (Original) An equalizer according to claim 23, further including a classifier for identifying ones of the path metrics computed for the previous symbol as better path metrics than other ones of the path metrics computed for the previous symbol, wherein the subset of states selected for the previous symbol are states corresponding to the identified better path metrics.

30. (Original) A decoder according to claim 29, wherein each path metric includes a measure of Euclidean distance.

31. (Original) A decoder according to claim 23, wherein the plurality of decision devices consists of four decision devices, each decision device corresponding to two respective elements of the constellation defined by the trellis code.

32. (Original) An equalizer according to claim 23, wherein the trellis code is compliant with a standard for digital television terrestrial broadcast adopted by the Advanced Television Systems Committee (ATSC).